

novel and interesting in the chemical progress of the expiring year.

The *Journal de Genève* of December 23] gives the following account of the experiments :—

One of the most interesting physical experiments of our time has just been made at Geneva with rare success in the laboratory of the Society for the Manufacture of Physical Instruments. M. Raoul Pictet has succeeded in obtaining, by means of ingeniously combined apparatus, the liquefaction of oxygen gas. The following is the process by which the curious result was obtained :—

By a double circulation of sulphurous acid and carbonic acid, the latter gas is liquefied at a temperature of 65° of cold, under a pressure of from four to six atmospheres. The liquefied carbonic acid is conducted into a tube four metres long; two combined pumps produce a barometric vacuum over the acid which is solidified in consequence of the difference of pressure. Into the interior of this first tube containing solidified carbonic acid is passed a tube of a slightly less diameter, in which circulates a current of oxygen produced in a generator containing chlorate of potash and the form of which is that of a large shell thick enough to prevent all danger of explosion. The pressure may thus be carried to 800 atmospheres.

Yesterday morning (December 22), all the apparatus being arranged as described, and under a pressure which did not exceed 300 atmospheres, a liquid jet of oxygen issued from the extremity of the tube, at the moment when this compressed and refrigerated gas passed from that high pressure to the pressure of the atmosphere.

The great scientific interest of this experiment is that it demonstrates experimentally the truth of the mechanical theory of heat, by establishing that all gases are vapours capable of passing through the three states—solid, liquid, and gaseous. Only twenty days ago M. Cailletet, as we have said, succeeded in liquefying the bioxide of nitrogen, under a pressure of 146 atmospheres and at a temperature of 11° of cold. After the experiment of M. Raoul Pictet there remain not more than two elemental gases which have hitherto escaped the attempt at liquefaction—hydrogen and nitrogen.

The experiment above described was to be repeated on Monday and subsequent days, with some slight changes in the processes and the arrangement of the apparatus.

NOTES

SOME interesting experiments with the telephone have been made by Mr. W. H. Preece between Dublin and Holyhead through the submarine cable. Conversation was freely maintained and songs were sung on each side and heard and appreciated on the other. The articulation was excellent, but muffled, as though the speakers spoke through respirators. This is what might have been expected from the static induction of the cable. It is the longest actual cable yet spoken through, its length being sixty-seven miles.

AT their last sitting the enlarged Council of the Paris Observatory were occupied in considering the question of the position of French meteorology. M. Dumesnil, the representative of the minister, was obliged to silence some members of the minority who were assailing the character of some of the physicists having the control of the Observatory and the transmission of the warnings to the sea-ports. A large majority rendering justice to the ingenuity displayed and to the highly scientific nature of the warnings, passed a vote recommending the administration not to alter the present condition of things at the Observatory.

DR. CARLO GHINOZZI, Professor of Medical Clinic at the Istituto Superiore of Florence, for many years colleague and afterwards successor of Prof. Bufalini, died on Saturday, the 15th instant, at the age of 66 years.

IN Bonn a committee has been formed consisting of leading citizens and Professors Bauerband, Kekulé, and Proschel, of the University, for the purpose of erecting a monument to the late Prof. Jacob Noeggerath, whose death last September we briefly alluded to at the time. Prof. Noeggerath was born in Bonn October 10, 1788, and since the foundation of the university in 1818 had been connected with it as Professor of Mineralogy. As a successful teacher of the natural sciences he acquired an unusually widespread fame, and the majority of the present Prussian mining officials pursued their studies under his direction. His general scientific researches touch on a number of interesting geological questions, such as the formation of basalt, &c.; but his chief efforts were directed to an exhaustive study of the mineralogy and geology of Rhenish Westphalia, the results of which are to be seen in the magnificent mineralogical collection at Bonn, and the rapid development of the mining interests in this district. As a favourite writer of popular works on scientific subjects, he contributed in no small degree to the general taste for this class of literature now prevalent in Germany.

THE expedition sent out by the Dutch Geographical Society for the exploration of Sumatra has met with a severe check by the sudden death of its leader, M. Schouw Landvort. His extensive knowledge, indomitable perseverance, and great powers of endurance, fitted him eminently for the position, these qualities being notably evidenced by the bold journey across the middle of the island, through hitherto unknown regions, in the company of natives only, which we had occasion lately to chronicle.

AT the meeting of the Council of the Zoological Society on Wednesday last week, the president, the Marquis of Tweeddale, proposed that the silver medal of the Society should be awarded to Mr. Robert Hudson, F.R.S., in acknowledgment of the valuable services he had rendered to the Society for the fifty years that he had been a Fellow thereof. The motion was carried unanimously at the full meeting of the Council.

THE organisation of public instruction in France is undergoing an exceedingly beneficial change. A decree, published in the *Journal Officiel* of December 17, establishes a representative Council of Public Instruction under the title of "Comité Consultatif." The committee is divided into three different sections corresponding to the three divisions of public instruction in France, primary, secondary (grammar schools), and superior (universities). Each section is to appoint its president and secretary. The three sections in general session are to be presided over by the minister. Some of the members are appointed by the minister to serve during a period of five years, others are members *ex officio*. The minister cannot elect any who are not members of the teaching body or of the Institut. The directors of the administration of primary, secondary, or superior instruction are *ex officio* members of their respective sections. They meet yearly at a certain fixed period. The opinion of the committee is not binding, but it must be taken on a number of matters, such as bills which are to be presented to Parliament, modification of programmes, &c. Another decree appoints the members of the three committees. Among these are many names well-known to science, as MM. Laboulaye, Würtz, Claude Bernard, Vulpian, Gavarret, Chevreul, Faye, Berthelot, Milne-Edwards, Puiseux, and Desains.

THE following are the probable arrangements for the Friday Evening Meetings at the Royal Institution, before Easter, 1878:—January 25, Prof. Huxley, F.R.S., "William Harvey;" February 1, Wm. Henry Preece, C.E., "The Telephone;" February 8, Matthew Arnold, "Equality;" February 15, P. L. Sclater, F.R.S., "Zoological Distribution and some of its Difficulties;" February 22, Prof. Roscoe, F.R.S.; March 1, Richard Liebreich, M.D., "The Deterioration of Oil Paintings;" March 8, Prof. Goldwin Smith, "The Influence of

Geographical Circumstances on Political Character;" March 15, Lord Rayleigh, F.R.S.; March 22, Prof. Tyndall, F.R.S.; March 29, Prof. Dewar, F.R.S.; April 5, Sir John Lubbock, Bart., M.P., F.R.S.; April 12, Sir Joseph Dalton Hooker, C.B., Pres. R.S., "The Distribution of Plants in North America."

PROF. BARFF begins his juvenile lectures at the Society of Arts next Wednesday. His subject is "Coal and its Components."

VOLCANIC eruptions are threatening Iceland again. The last number of the *Skuld*, published in Eðkifjódur, states that on the evening previous an unprecedented heat was suddenly felt, so strong that the inhabitants thought themselves in the vicinity of a vast conflagration. The phenomenon was followed by alternate gusts of rain and showers of volcanic ashes accompanied by subterranean rumblings.

THE German Government has lately named a new steamer after the well-known meteorologist, Prof. Dove, of Berlin, in recognition of the advantages accruing to navigation from his many observations and discoveries.

THE Italian Geographical Society has received news from Signori Martini and Cecchi, who have penetrated into Shoa. There is no intelligence of the Marquess Antinori and the engineer Chiarini, whose fate causes grave anxiety.

THE Geographical Society of Paris held a banquet last Saturday to commemorate the fifty-seventh anniversary of its foundation. Among the toasts which were given we must notice that of Mr. Gordon Bennett, the enterprising director of the *New York Herald*, who originated Stanley's fruitful mission, and the King of the Belgians, by MM. Levasseur and de Lesseps.

NEW halls of exhibition for antiquities have been opened in the Louvre. An interesting anthropological exhibition will be opened on January 15 at the Palais de l'Industrie. It will be confined to the discoveries made in South America by the several scientific missionaries sent to that region by the French government. The exhibition will be open only till March 1.

WE have received from Messrs. De la Rue and Co. some specimens of their exquisitely-printed Indelible Diaries, Pocket Diaries, Memorandum Books, and Calendars for the coming year. Our readers have doubtless already supplied themselves with one or other of these. If not, the following statement will recommend the Pocket Diary to every lover of science:—We not only find everything that one finds generally in such a pocket companion, but, under the careful editorship of Mr. Godward, the amateur astronomer is supplied with information as to astronomical phenomena, including the times of rising, southing, and setting of the five principal planets, and the illuminated discs of Venus and Mars, and occultations visible at Greenwich. The physiographer finds meteorological averages of mean temperature, rainfall, and barometer, hints as to weather forecasts, and the magnetic elements. Physical data are not forgotten, and the conversion of metric measures into British inches and centigrade readings into Fahrenheit are given. The geographer and statistician have also facts stored up for them which will certainly be often referred to in the course of the 8,000 odd hours which make up the year. One thing, and one thing only, we miss—the old three-page article and exquisite steel engraving which brought home to everybody the latest thing of mark in the progress of the sciences of observation.

WE learn with pleasure in perusing the last pamphlets sent to us by Capt. Howgate on his intended Polar Colony, that the use of small pilot balloons has been recommended to Mr. Sherman, the meteorologist of the preliminary Florence expedition. The

method practised by M. de Fonvielle in the beginning of 1877 at Secretan's workshop for ascertaining the altitude of clouds and the direction of the winds by throwing ballonets into the air, has been improved upon in America and will be used regularly in arctic work. This success has led MM. de Fonvielle and Secretan to prepare instructions for the above purposes, in the hope of extending the use of these ballonets to the bringing of news from ships in danger or expeditions severed from the civilised world either by sandy wastes or icy solitudes. A number of examples cited in recent works on ballooning may be regarded as an indication that the old mode of throwing bottles into the sea may be replaced by a new method equally simple and having at least a thousand more chances of success.

CAPT. HOWGATE's scheme for Polar colonisation has been brought before the Council of the Paris Geographical Society, and it is expected that a resolution favourable to the contemplated expedition will be adopted in time to be sent to America before Congress has come to a final decision on that important object.

AN interesting discussion arose at the last meeting of the Anthropological Institute, on the contents of the small oval pits which have been discovered in the neighbourhood of some of the shafts at Cissbury. The president, Mr. John Evans, pointed out marks on the bone of a small ruminant, probably a roebuck, which indicated that it had been used in the process of weaving. A carding-comb, a terra-cotta bead, large enough to serve as a spindle-whorl, and a loom-weight of chalk were found in the same pit. Lord Rosehill mentioned that chalk weights were also met with in Mr. Tindale's pit at Cissbury, and some were now in his museum. Mr. Park Harrison was of opinion that the little pits were graves, but they appeared to have been disturbed at a remoter period and used for more than one interment. The potsherds found in them were of various dates, some being of a type more common on the Continent than in this country.

WE notice the appearance of the first two of the three divisions of the *Jahresbericht für Chemie* for 1876, which completes the report of physical, inorganic, organic, vegetable, and physiological chemistry, leaving the analytical, technical, mineralogical, and geological portions for the closing number. Prof. Fittica, of Marburg, is still editor-in-chief, and he is assisted by C. Böttiger, C. Hell, H. Klinger, A. Laubenheimer, E. Ludwig, A. Naumann, F. Nies, H. Salkowski, Z. H. Skraup, K. Zöppritz, G. Schultz, and W. Weyl, the latter two replacing K. Birnbaum and A. Michaelis in the editorial corps of the preceding year. The publication of the *Jahresbericht* has been much more prompt since the appearance of Prof. Staedel's *Jahresbericht für die reine Chemie* in 1873, which although confined exclusively to pure chemistry, renders a tolerably complete report for each year in the following September.

THE two last numbers of the *Izvestia* of the Russian Geographical Society contain a very interesting account, by Dr. Wojeikoff, of his travels in Japan, made during the summer of last year. Besides a vivid description of the country visited, and of its inhabitants, the reader will find in these papers many interesting data as to the physical characteristics of the land, with many determinations of heights, the climate, the products, &c. Two separate papers are devoted, one to the exterior trade of Japan, and the other to the population and its dependence upon agriculture, as compared with other countries.

THE Moscow Society of Friends of Natural Science has undertaken various anthropological researches for the exhibition which will take place at Moscow in 1879. One of them was made in the Ryazan government by M. Néfédoeff, who has already discovered and excavated ten unknown and very interesting *koorganes* (mounds) in Kasimov district. He has found there

eleven human skeletons with many ornaments, some of them in bronze, representing snakes, heads of various animals, &c.; and a comparison of the Ryazan skulls and ornaments with those excavated in the Moscow and Meriaks *koorganes*, proves that they belong to quite a different people. Altogether the discovery promises to be of great importance. Another gentleman sent by the same society, M. Bensengr is busily engaged in making anthropological measurements and ethnographical descriptions of the Ryazan Tartars.

At the meeting of the St. Petersburg Society of Naturalists on December 9, M. Polyakoff—returned from a journey to Western Siberia, the Altai, and Alatan Mountains—read a report on the interesting question as to the state of Central Asia during the glacial period. After having described the boulder-clays, boulders, and morainic deposits he met with during his journey, as well as the present characters of the flora and fauna of the country, he concluded in favour of a complete glaciation of Central Asia during the last ice-period.

WE notice a valuable Russian work, just published by M. Mushketoff, "Materials for a Knowledge of the Geology and of the Mines of the Zlatoust Mine District in Southern Ural." It is the result of careful study, contains many new and valuable data, and is accompanied by an elaborate geological map.

At the last meeting of the Russian Geographical Society on December 8, Prof. Ujfalvy, of the Paris High School of Eastern Languages, who was sent by the French Government on an anthropological mission to Central Asia, made a very interesting communication on his work in the Russian provinces of Orenburg, Fergana, and Turkistan. After a careful study of the Bashkirs, he arrived at the conclusion that this people are the original stock of the Madjars; that the Mescheryacks are intermediate between Bashkirs and Ostyacks, and that the Tepteri are true Tartars. The conclusions arrived at as to the various peoples of Turkistan are more complicated and could not be briefly stated; but the learned professor has collected many important data, and has obtained valuable photographs, collections of old coins from Turkistan, of stone implements from Siberia, &c.—At the same meeting M. Minaieff referred to the work he has compiled, by order of the society, on the tracts of Central Asia occupying the upper parts of the Amu-daria. The work is divided into three parts: geographical, ethnographical, and linguistic, the former being the richest, and sums up all we know at present about those lands.

COL. GORDON has lately entered into a contract with Messrs. Yarrow and Co., of Poplar, for four steel steamers of small draught. He intends exploring the Albert Nyanza and the rivers flowing into it. The steamers are to be carried as far as possible by water, and are to be composed of several portable pieces of about 200 lbs. each, to be put together on arrival at their destination. Col. Gordon and his party are reported to be in good health.

SINCE the beginning of last year a new scientific journal has appeared at Christiania (Cammermeyer) under the title *Archiv for Mathematik og Naturvidenskab*. It is edited by Herr Sophus Lie, Jakob Worm Müller, and G. O. Sars. The journal is published in four yearly parts which form a volume of about 500 pages. We have received the first seven parts, and may congratulate the editors and publishers on the decided step of progress which the appearance of this journal evidently marks in the history of Norwegian science. Amongst a number of mathematical papers by Herr Sophus Lie, and others of minor interest, there are some interesting geological treatises by Herr Karl Pettersen, viz., on the orography of Norway, on the geology of the Salten fjord, on the giant's cave near the Lavangen fjord in the neighbourhood of Sandvort, and on the fjords of Northern

Norway. Herr S. A. Sexe has contributed two papers on some old coast-lines and on the direction of the winds in the so-called "stille Belt." Herr Amund Helland is the author of a treatise on the ice-filled fjords of Northern Greenland, and of an elaborate account of the varying quantities of chlorine present in the sea-water of the German Ocean, the Atlantic, and Davis' Straits. Herr G. O. Sars contributes an interesting note on the scientific expeditions in the Atlantic during 1876, and some detailed researches on the invertebrate fauna of the Mediterranean (with plates.) Herr J. Worm Müller gives some notes on Malassez's method of estimating the number of red corpuscles in blood as well as on the relation between the number of red corpuscles and the colouring power of blood. Of the remaining papers we note—a metallurgical paper by E. Münster; on the influence of the eccentricity of the orbits of heavenly bodies upon the quantity of heat they receive from the sun, by H. Geelmuyden; and two zoological notes, one by J. Koren and D. C. Danielssen, the other by Herman Friele.

THE additions to the Zoological Society's Gardens during the past week include a Greater Sulphur-Crested Cockatoo (*Cacatua galerita*) from Australia, presented by Miss Rosetta Cohen; a Grey-breasted Parakeet (*Bolborhynchus monachus*) from Monte Video, presented by Mr. Alex. F. Baillie; a Moccasin Snake (*Tropidonotus jasciatus*), born in the Gardens.

CERTAIN MOVEMENTS OF RADIOMETERS¹

NEARLY two years ago Mr. Crookes was so good as to present me with two of his beautiful radiometers of different constructions, the discs of one being made of pith, and those of the other of roasted mica, in each case blackened with lampblack on one face. With these I was enabled to make some experiments, having relation to their apparently anomalous movements under certain circumstances, which were very interesting to myself, although the facts are only such as have already presented themselves to Mr. Crookes, either in the actual form in which I witnessed them, or in one closely analogous, and have mostly been described by him. Although it will be necessary for me to describe the actual experiments, which have all been repeated over and over again so as to make sure of the results, I do not bring forward the facts as new. My object is rather to endeavour to co-ordinate them, and point to the conclusions to which they appear to lead.

I do not pretend that these conclusions are established; I am well aware that they need to be further confronted with observation; but as I have not leisure to engage in a series of experiments which would demand the expenditure of a good deal of time, and have lately been urged by a friend to publish my views, I venture to lay them before the Royal Society, in hopes that they may be of some use, even if only in the way of stimulating inquiry.

In describing my experiments I will designate that direction of rotation in which the white face precedes as positive, and the reverse as negative. It will be remembered that, under ordinary circumstances, radiation towards either radiometer produces positive rotation.

1. If a glass tumbler be heated to the temperature of boiling water, and inverted over the mica radiometer, there is little or no immediate motion of the fly, but quickly a negative rotation sets in, feeble at first, but rapidly becoming lively, and presently dying away.

2. If after the fly has come to rest the hot tumbler be removed, a positive rotation soon sets in, which becomes pretty lively, and then gradually dies away as the apparatus cools.

3. If the tumbler be heated to a somewhat higher temperature, on first inverting it over the radiometer there is a slight positive rotation, commencing with the promptitude usual in the case of a feeble luminous radiation, but quickly succeeded by the negative rotation already described. If the tumbler be heated still more highly, the initial positive rotation is stronger, and lasts longer, and the subsequent negative rotation is tardy and feeble.

4. If the pith radiometer be treated as in § 1, the result is the same, with the remarkable difference that the rotation is positive instead of negative; it is also less lively.

¹ Paper read at the Royal Society, December 20, by Prof. G. G. Stokes, Sec. R.S.